sions, as in the case of the typical species. The leaves also differ quite perceptibly, being much larger for the same age in the variation, and having larger petioles, both for the leaf proper and for the leaflets. The margins are more strongly serrate, tending to double serrate. The internodes of the stem are much longer in the variety, causing the leaves to be fewer and more scattered. The nodes are more swollen, as are the leaf petioles at the base, making a much larger leaf scar, but the axillary buds are smaller. The stem of the type species is quite rough, furrowed, and warty, especially as it grows older, while the variety is much smoother. The fruit of the variety is more abundant, berries larger, and in more open corymbs.

In short, the whole aspect of the variety is more grape-like, and for this reason we suggest the name *A. quinquefolia*, var. *vitacea*.

NOTES ON "MOUNTAIN LEATHER," FROM RED ROCK CAÑON, COLORADO.

BY E. B. KNERR.

The red sandstone of the Red Rock Cañon, Colorado, along the Colorado Midland railroad, is extensively quarried for building purposes. In the seams and joints of this rock may be found a tenacious asbestos or paper-like mineral, known as "mountain leather." When the seam is large, allowing of a thicker deposit, the mineral is rather spongy, and is then known as "mountain cork." An analysis of the mineral gave the composition as follows:

SiO_2	59.02
Al_2O_3	8.51
MgO	9.57
K_2O	.81
Na_2O	4.28
H_2O	18.21
	100.40

RECENT ADVANCES IN THE STUDY OF THE NERVOUS SYSTEM.

BY C. JUDSON HERRICK, OTTAWA.

The past decade has been a period of unparalleled activity in the study of the nervous system, both human and comparative. Investigation has appreciated more and more the value of the latter method. The points mentioned in this brief review are almost all the direct outgrowths of improved histological and embryological methods.

One of the most valuable results of these studies has been the establishment of safe homologies through the entire series of vertebrates, from the fish to man. The commissures have naturally received especial attention. The callosum, formerly supposed to belong exclusively to the higher mammals, has, in recent years, been found by various observers in the kangaroo, a few birds, serpents, and batrachians. About two years ago, it was found by my brother in the alligator,* and by him last year in the opossum, strongly developed.† Last winter, in working up material col-

*Notes on the Brain of the Alligator, by C. L. Herrick, Journal of Cincinnati Society of Natural History, 1890.

†Journal of Comparative Neurology, February, 1892.

lected by us from the Ohio river the summer previous, he found unmistakable evidences of a callosum in the bony fishes. Our best morphologists have hitherto been unanimous in describing the fish brain as lacking the callosum. The common drum, *Haploidonotus*, however, has this commissure well developed.* My friend, Mr. C. H Turner, has also found the callosum in several groups of birds, where its presence had not hitherto been suspected.† The other great commissures of the brain have been studied with results quite as satisfactory. If space permitted, we might dwell on the philosophical significance of these facts; suffice it to say, that the homologizing of the commissures of the brain is a long step in the direction of a solution of the vexed question of the segmentation, or metamerism, of the head — a step, too which once surely taken, might lead directly to that solution.

The so-called "pineal gland" has been the subject of active discussion from the day that Spinoza declared it to be the seat of the soul until now. Here, too, the comparative method has borne good fruit. Whatever its present function, (and there are nearly as many opinions here as there are authors,) its origin seems clear. It is present in all vertebrates, and in the lower is more perfectly developed than in the higher. Moreover, it is larger and more perfectly developed in the young than in the adult. These points show that its significance is to be sought in the past rather than the present. It is now several years since the bold suggestion was hazarded that it formerly functioned as an eye. Of this, the evidence grows yearly more conclusive. Alborn, on petromyzon,‡ Herrick, on the lizard and black snake,§ and many others, find evidence of a degenerate retinal surface in the pineal body, while Ritter, in a paper on "The Parietal Eye in Some Lizards from the Western United States," describes ‖ a pigmented retinal epithelium in the pineal body, and in the same vesicle a rudimentary lens and other evidences of the so-called parietal eye. Appearing at almost the same time in the *American Journal of Science*, (February, 1891,) is Professor Marsh's description of the skulls of certain North American fossil reptiles, the Dinosaurs, with a large "parietal foramen," an opening in the top of the head at the union of the parietal and squamosal bones. This he regards as the socket of a "pineal eye."

In the fishes there is great modification of the relations. The compact, conical body of the mammals is represented by a very slender tube, with walls consisting of a single layer of epithelium. This tube passes up toward the top of the cranium, which, however, we are told it never reaches.¶ Whatever may be the relations in the adult teleostean brain, they are certainly not as described in the case of the young. I have sections of a young catfish one inch long, cut through the entire body, which show this tube very clearly passing up to the skull and spreading out to form a closed sac, which I have no hesitation in saying is the rudiment of a primitive optic vesicle. The skull, too, at this point is considerably thinner than in the adjacent regions.

Of supreme importance in all matters which concern the origin of nerve cell and nerve fiber, is a recent paper, by Prof. Wm. His, on "Histogenesis and Combination of Nervous Elements."** The nervous system, at an early embryonic stage, consists of a simple tube, running the entire length of the body, with walls of single-layered columnar epithelium. This relation persists in the adult, and is the basis of the

* Ibid., December, 1891.

† Ibid, March, 1891..

‡ Zeits. f. Wiss. Zoölogie, XXXIX.

§ Jour. Comp. Neurology, I, pp. 27, 28.

‖ Bull. Mus. Comp. Zoölogy, January, 1891.

¶ Wiedersheim's Comparative Anatomy, Eng. tr., p. 142; and, in the case of the catfish, by Professor Wright, in the Proceedings of the Canadian Institute, vol. II, p. 363.

** Histogenese und Zusammenhang der Nerven-Elemente, Archiv. f. Anat. und Phys., 1890.

connective tissue framework of the brain. These cells shrink and collapse in the center; but in lower brains, at least, our sections seem to show that they retain their continuity from the ventricular to the outer surface of the brain and cord. Between these cells (spongioblasts) there appear, according to Professor His, at an early stage, isolated nuclei, probably derived from the nuclei of the spongioblasts. These so-called neuroblasts have remarkable powers of motion, and migrate, sometimes in large numbers, to adjacent parts of the brain or spinal cord, as the case may be. From these neuroblasts are derived all nerve cells and fibers; from the spongioblasts, the connective tissue elements of the brain. In a subsequent paper, on the development of the human spinal cord, Professor His applies these principles in detail, tracing the origin of the various nuclei and tracts of the cord and medulla. For example, he shows how the olivary bodies are produced by a pouching off of a portion of the fourth ventricle on each side, and the migration of its cells to their positions near the ventral surface of the medulla.

This principle finds application elsewhere frequently in the brain. The cortical cells of the cerebrum, for example, are not all developed where they lie, but several well-marked areas of proliferation have been found from which cells pass to their respective sites. Thus, in the axial lobe, or brain base, of several groups of reptiles, cells are very rapidly formed, which seem to pass to the adjacent regions of the cortex.* Mr. Turner finds the same relations in birds.† In the fish brain, the entire *cortex cerebri* is represented by an epithelial membrane with no nervous organs, and these areas of proliferation in the axial lobes perform the whole function of the cerebrum.

We pass now to a series of investigations which may truly be called revolutionary. Since the time of Spinoza, it has been the custom to consider the central nervous system as analogous to a central battery system, toward which messages are sent along the various nerve fibers from the sensory organs, and from which similar messages are sent to the muscles and other instruments of volition. The transmission of such messages implies the physical union of the axis cylinder of a nerve fiber with a cell of the sensory or motor organ in question, on the one hand; on the other hand, physical union of the same fiber with some cell in the central nervous system, these cells being so connected as to insure the continuity of the motor with the sensory nerve systems. Upon this theory Professor Meynert based his now famous scheme of projection systems, tracing the path of a sensory impulse from cell to fiber and from fiber to cell, until it reaches the psychical cells of thought, in the cortex of the frontal lobes of the cerebrum, thence to the motor cells, the striatum, and the motor nerve.

But now Professor Golgi and his followers come forward and affirm that no nerve fiber is in direct physical continuity with a nerve cell at each end. Nervous excitation is not a mere transmission of an impulse through a suitable conductor, for the circuit is broken at many points. By processes of impregnation of the tissues with chromate of silver, now familiar to every histologist, they claim to make every finest nerve fibrilla stand out with diagrammatic distinctness, and that when thus differentiated every cell is found to be quite independent of every other cell. From each cell there pass two kinds of processes: First, an axis-cylinder process, which passes into the nerve fiber; and second, the protoplasmic processes, smaller and much branched, said by Golgi to be nutritive in function, but by others regarded as undoubtedly nervous. This, then, is our neurological unit, from which all nervous tissues are elaborated, a cell with its processes of two kinds. The axis-

*Jour. Comp. Neurol., I, p. 17.

†*Ibid.*, p. 71.

cylinder process always ends free, and usually breaks up at the tip into a brush of fine fibrils, which may be called the "terminal brush."

As to the relations of these nerve units to each other, it must first be borne in mind that, according to these authors, no nerve fiber passes directly into a cell at each end; second, that no ganglion cell has more than one axis-cylinder process springing from it; and, third, that each of these units is anatomically quite distinct from all the others. They do, however, come into very close relations. They may be adjacent and intertwine their processes, but actual continuity cannot be demonstrated. All this leads so conservative a writer as Professor Obersteiner to remark: "Hence, although we were before obliged to assume a continuity of the elements for the uninterrupted propagation of the nervous excitation, now we may no longer utterly reject the view that possibly even their contiguity may have the same functional significance."*

While our own observations lead to the belief that Golgi's method is very unreliable as a histological process, yet the relations here described are very strongly suggested, even by some of our hæmatoxylin preparations; and there can be but little doubt that mere proximity or contiguity is sometimes sufficient for nervous transmission. It would seem, then, that the neuroglia, or ground substance of the brain, must be in some way able to act as a conductor of nervous force, or else the process of transmission is analogous to induction rather than conduction.

The same anatomical relations have been very recently discovered in the invertebrates. If these positions can be substantiated, what a revolution it will work in our conceptions of the nervous system! Our whole theory of the nervous mechanism must be reconstructed.

Much might be said of the recent advances in the localization of brain functions, particularly in man and the higher apes. But more significant still is the fact that attention is being directed from the brains of the lower animals to the mental processes of which they are the organs; and the day is not far distant when we shall have a science of comparative psychology. As our knowledge of the functions of the human brain have been derived chiefly from comparison with lower animals, it seems not unreasonable that the same method should bear good fruit in the study of the mind.

A BREATHING WELL IN LOGAN COUNTY.

BY J. T. WILLARD, KANSAS STATE AGRICULTURAL COLLEGE.

For a number of years Mr. R. L. Smith, of Winona, has noticed that two wells there blow out air at times and draw it in at other times. He has also noticed a close connection between their action and the weather. One well he has noticed more especially, and became so satisfied that the movement of air was connected with the state of the atmosphere that he called it a natural barometer. He was very desirous that the well should be observed by some scientific man with the necessary instruments. An aneroid barometer was sent him to make observations with, at the same time recording the state of the well. His observations indieated quite clearly that the movement of air in and out of the well was dependent on the pressure of the atmosphere. As the case seemed interesting, the writer visited the well, taking with him an excellent mercurial barometer and such other apparatus as seemed likely to be useful.

*Recent Views on the Structure of the Nervous System, Naturwissenschaftlichen Rundschau, VII, 1 and 2. Translated in Jour. Comp. Neurol., II, pp. 73-84.